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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

APPELLANT:	Peter DIETZ	CONFIRMATION NO. 7857
SERIAL NO.:	10/501,175	GROUP ART UNIT: 2859
FILED:	July 9, 2004	EXAMINER: Dixomara Vargas
TITLE:	MAGNETIC RESONANCE APPARATUS WITH A FORCE GENERATOR FOR PREVENTING LORENTZ FORCE-CAUSED MOVEMENT OF CONDUCTIVE STRUCTURES	

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Commissioner for Patents
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S I R:

APPELLANT'S MAIN BRIEF ON APPEAL

In accordance with the provisions of 37 C.F.R. §41.37, Appellant herewith submits his main brief in support of the appeal of the above-referenced application.

REAL PARTY IN INTEREST:

The real party in interest is the assignee of the present application, Siemens AG, a German corporation.

RELATED APPEALS AND INTERFERENCES:

There are no related appeals and no related interferences.

STATUS OF CLAIMS:

Claims 1-11 were cancelled. Claims 12-22 are the subject of the present Appeal, and constitute all pending claims of the application. Each of claims 12-22 stands rejected in the Office Action dated May 2, 2006.

STATUS OF AMENDMENTS:

No Amendment was filed subsequent to the final rejection in the May 2, 2006 Office Action.

SUMMARY OF CLAIMED SUBJECT MATTER:

The subject matter of the claims on appeal is a magnetic resonance apparatus having a force generator that generates forces, and mechanically applies those forces to an electrically conductive structure of the magnetic resonance apparatus in order to counteract Lorentz forces that occur due to the generation of eddy currents caused by another component of the magnetic resonance apparatus.

Independent claim 12 on appeal is set forth below, with citations to exemplary locations in the specification wherein the elements thereof are described.

12. A magnetic resonance apparatus comprising:

a basic field magnet for generating a basic magnetic field (magnet 100; p. 5, l. 18-21);

at least one eddy current generator (gradient coil system 200; p. 7, l. 14-18)

at least one electrically conductive structure, other than said eddy current generator, in which eddy currents caused by said eddy current generator can occur, said eddy currents interacting with said basic magnetic field to produce Lorentz forces; (vacuum reservoir 140; p. 7, l. 26 – p. 8, l. 2) and

a force generator attached to said at least one electrically conductive structure, said force generator being designed and controlled for mechanically applying forces to said electrically conductive structure to counteract said Lorentz forces to substantially preclude movement and deformation of said electrically conductive structure due to said Lorentz forces from occurring. (force generator 400; p. 8, l. 2-5)

Since claim 13 is being separately argued, claim 13 is set forth below with citations to exemplary locations in the specification at which the elements thereof are described.

13. A magnetic resonance apparatus as claimed in claim 12 wherein said eddy current generator has a control unit associated therewith, (gradient control unit 250) and wherein said force generator comprises a control unit for operating said force generator dependent on operation of said control unit for said eddy current generator. (p. 8, l. 5-11)

As an exemplary embodiment of the invention, Figure 1 shows a longitudinal section through a magnetic resonance apparatus. The magnetic resonance apparatus has an essentially hollow-cylindrical basic field magnet 100 with which, at least within an imaging volume 150 of the magnetic resonance apparatus, an optimally homogenous static basic magnetic field can be generated. (p. 5, l. 17-21) The basic field magnet 100 has an essentially hollow-cylindrical helium vessel 100 made of non-magnetic stainless steel, in which superconducting solenoid coils 113 are arranged on a winding carrier, these solenoid coils 113 being cooled to 4.2 K by the liquid helium surrounding them. (p. 5, l. 22-25)

The magnetic resonance apparatus also has a gradient coil system 200 composed of gradient coils and associated shielding coils and with which a gradient control unit 250 is associated. The essentially hollow-cylindrical gradient coil system 200 is attached in the cylindrical hollow of the vacuum vessel 140 by wedging. (p. 6, l. 10-14)

To control the currents in the coils, the gradient coil system 200 is connected with the gradient control unit 250. Within the imaging volume 150, rapidly switched

magnetic gradient fields can be superimposed on the basic magnetic field with the gradient coil system 200 fed with current. (p. 6, l. 15-18)

So that the switched gradient fields in the imaging volume 150 are not distorted by eddy current induction and eddy current magnetic fields as a consequence thereof, the gradient control unit 250 operates with correspondingly predistorted control quantities for the currents of the gradient coils and associated shielding coils. For this purpose, the gradient control unit 250 has a predistortion device 260 that includes respective predistortion units 261, 262 and 263 for each of the three gradient axes x, y and z. (p. 7, l. 14-20)

Furthermore, the magnetic resonance apparatus has a force generator 400 that, as a hollow cylinder of small wall thickness, is attached like a layer to the inner cylinder jacket of the vacuum reservoir 140. (p. 7, l. 26-28) Due to the switched gradient fields, in the inner cylinder jacket of the vacuum reservoir 140 eddy currents are induced that interact with the basic magnetic field to produce Lorentz forces, such that (without countermeasures) deformation, movement and/or oscillation of the inner cylinder jacket would result. (p. 7, l. 28 – p. 8, l. 2) The force generator 400 is fashioned and can be controlled such that the force generator 400 can generate forces counteracting the aforementioned Lorentz forces, such that the deformation, movement and/or oscillation of the inner cylinder jacket is prevented (i.e., never arises). (p. 8, l. 2-5) For control of the force generator 400, a force generator control unit 490 is associated with the force generator 400. The force generator control unit 490 is linked with the gradient control unit 250, in particular its predistortion device 260. The predistortion of the coil currents can be used to control the force generator

400, since the predistortion mirrors the precise portion and the time curve of the eddy currents. (p. 8, l. 5-11)

As an exemplary embodiment of the invention, Figure 2 shows in sections a detailed longitudinal section through the force generator 400 in a first embodiment. The force generator 400 is formed by three layers 410, 420 and 430 in which electrostrictive fibers 475 or bundles of such fibers are arranged. The electrostrictive fibers 475 are arranged in the layer 430 corresponding to the spatial distribution of the Lorentz forces (that are caused by the z-coils fed with current) acting on the inner cylinder jacket of the vacuum reservoir 140. In the layers 420 and 410 the electrostrictive fibers 475 are arranged corresponding to the Lorentz forces caused by the x- and y-coils fed with current. A very fine spatial resolution thus can be achieved with the electrostrictive fibers 475. (p. 8, l. 12-21)

The electrostrictive fibers 475 are respectively arranged per layer 410, 420 and 430 between two contacting layers 415 and 416, 425 and 426 and 435 and 436. Electrically-insulating layers 440 and 445 are arranged between the contacting layers 426 and 415 as well as 416 and 425. Between the contacting layers 415 and 416, 425 and 426 and 435 and 436, electrical voltages can be applied that effect a contradiction of the electrostrictive fibers 475 and therewith a force is produced perpendicular to the surface of the inner cylinder jacket of the vacuum vessel 140. (p. 8, l. 25 – p. 9, l. 2)

The electrical voltages are provided by the force generator control unit 490, whereby the layer 420 is controlled by the predistortion unit 262 corresponding to a predistortion for the y-coils, the layer 410 is controlled by the predistortion unit 261

corresponding to a predistortion for the x-coils, and the layer 430 is controlled by the predistortion unit 263 corresponding to a predistortion for the z-coils. (p. 9, l. 3-7)

As a further exemplary embodiment of the invention, Figure 3 shows in sections a detailed longitudinal section through the force generator 400. Electrostrictive fibers 475 are uniformly distributed in a layer 450. (p. 9, l. 8-10) The layer 450 is disposed between two contacting layers 455 and 456, with both contacting layers 455 and 456 being divided in a congruent manner into sub-contacts. The partial sub-contacts are insulated from one another and cover the layer 450 like tiles. (p. 9, l. 10-13) Two sub-contacts that are opposite one another relative to the layer 450 form a pair. With the force generator control unit 490, electrical voltages can be applied to each of the pairs, with the voltage for each pair being adjustable independently of the voltages for the other pairs. (p. 9, l. 14-17) In the layer 450, corresponding regions of one or more of the electrostrictive fibers 475 thus can be controlled independently of one another and with different contractions. (p. 9, l. 17-19)

Compared to the first embodiment, the layer thickness of the force generator 400 is reduced so that the many sub-contacts can be controlled separately with different voltages. (p. 9, l. 20-22) For an equally effective control as in the first embodiment, the predistortions of the individual predistortion units 261, 262, 263 need not be used directly, but rather are first further processed in the force generator control unit 490 and transferred to the individual sub-contacts. For this further processing, in principle the Lorentz force spatial distributions that each of the coils causes on the inner cylinder jacket of the vacuum reservoir 140 are determined, for example by measuring, and to be stored in the force generator control unit 490. (p.

9, l. 22-29) Furthermore, in the second embodiment, due to the many sub-contacts, spatially different decay times of eddy currents that predominate in different regions of the inner cylinder jacket can be produced by a suitable control. (p. 9, l. 9 – p. 10, l. 2)

As a further exemplary embodiment of the invention, Figure 5 shows an area-covering arrangement of annular coils 510 on the surface of the gradient coil system 200. Each of the annular coils 510 is disposed, for example, corresponding to the sub-contacts of Figure 3 and is associated with one of the sub-contacts. Similar to the annular coils 511, 512, 521 and 522 of Figure 5, the annular coils 510 are fashioned only to detect radially-directed magnetic field components. (p. 11, l. 21) The respectively associated sub-contact can be controlled with the measurement signal of each one of the annular coils 510. Control on the basis of the predistortion, and likewise a separation of the magnetic field components with regard to the x, y and z axes, can be foregone. (p. 11, l. 21-24)

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL:

The following issues are presented for review in the present Appeal:

Whether the subject matter of claims 12-17 would have been obvious to a person of ordinary skill in the field of designing magnetic resonance apparatuses, under the provisions of 35 U.S.C. §103(a), based on the teachings of United States Patent No. 5,708,360 (Yui et al) in view of the teachings of United States Patent No. 5,764,059 (Mansfield et al); and

Whether the subject matter of claims 18-22 would have been obvious to a person of ordinary skill in the field of designing magnetic resonance apparatuses, under the provisions of 35 U.S.C. §103(a), based on the teachings of Yui et al,

Mansfield et al and the teachings of United States Patent No. 5,617,026 (Yoshino et al).

ARGUMENT:

Rejection of Claims 12-17 Under 35 U.S.C. §103(a) Based on Yui et al and Mansfield et al

The subject matter disclosed and claimed in the present application concerns a magnetic resonance apparatus that has at least one component, such as a gradient coil, that, in addition to its intended operation for generating a gradient field, unavoidably also serves as an eddy current generator. The magnetic resonance apparatus disclosed and claimed in the present application also includes at least one electrically conductive structure in which eddy currents caused by the eddy current generator can occur. The electrically conductive structure in which eddy currents caused by the eddy current generator can occur is a component other than the eddy current generator itself.

The force generator is *attached* to the at least one electrically conductive structure, this force generator generating forces that are mechanically applied to the aforementioned electrically conductive structure so as to counteract the Lorentz forces, thereby precluding movement and deformation of the electrically conductive structure that would otherwise occur due to the Lorentz forces. Since the at least one electrically conductive structure in claim 12 is differentiated from the eddy current generator, this means that the aforementioned force generator, in accordance with claim 12, is not attached to the eddy current generator itself, but instead is attached to the electrically conductive structure, which is a structure other than the eddy current generator. The basic underlying concept of the apparatus of

claim 12 is not to try to prevent the *occurrence* of Lorentz forces, but instead is to mechanically apply a force to a component that would be moved or deformed by such Lorentz forces, so that such movement and deformation does not occur.

In the final rejection, the Examiner stated that the Yui et al reference discloses the "claimed invention" except for the force that is applied being a mechanical force. The Examiner relied on the Mansfield et al reference as teaching the application of mechanical forces to counteract Lorentz forces, and stated it would have been obvious to a person of ordinary skill to apply mechanical forces to counteract the Lorentz forces, as taught by Mansfield et al, in the magnetic resonance imaging apparatus disclosed in the Yui et al reference, for the purpose of avoiding undesirable movement or vibration of the structure.

Appellant agrees that the Yui et al reference does not disclose the application of a mechanical force to counteract Lorentz forces in a magnetic resonance imaging apparatus, and further submits that the reason why there is no such disclosure in the Yui et al reference is relevant to the issue of whether it would have been obvious to make use of a mechanical force generator in the apparatus disclosed in the Yui et al reference. Appellant therefore will first explain why there is no mechanical force generator disclosed in the Yui et al reference.

The Yui et al reference begins by noting, at column 1, lines 56-65, the conventional use of an active shield gradient coil (ASGC) that has the purpose of effectively cancelling a so-called "leaking magnetic field" from the primary coil. This is accomplished by means of an appropriate current distribution at the cylindrical surface that encloses the primary coil.

As further explained at column 2, lines 9-27 of the Yui et al reference, the ASGC conventionally has a long current path due to the presence of current returns, thereby making it impossible to obtain a high speed gradient field switching characteristic or a large gradient magnetic field strength. Yui et al then describe the conventional solution to this problem, which involves cutting one or more of the current returns in the ASG.

Yui et al then further note, at column 2, lines 28-37, that this conventional approach has the disadvantage of degrading the gradient magnetic field linearity as well as the leaking magnetic field shielding power.

All of the embodiments disclosed in the Yui et al reference, therefore, are directed to ways to make use of the conventional technique of minimizing eddy current generation by minimizing, or making zero, the aforementioned "leaking magnetic field," while avoiding the aforementioned disadvantages of degrading the linearity of the gradient magnetic field and the shielding field.

All of the measures that are put to use in the Yui et al reference for achieving this goal are explained in a first embodiment, beginning at column 7, line 14 through column 11, line 25. In the next paragraph, beginning at column 11, line 26, it is stated in Yui et al that the result of all these measures is to make the leaking magnetic field produced by the current distributions of the primary coil and the connecting phase to be nearly zero at an exterior region of the coil, while generating the gradient magnetic field with a good linearity in the desired imaging field of view.

A second embodiment is then described in the Yui et al reference at column 12, lines 23-65, followed by a description of a third embodiment beginning at column 13, line 1 through column 14, line 62. The description of this third embodiment ends

with the same statement of the result that was noted above in connection with the first embodiment, namely the leaking magnetic field is made to be nearly zero at the exterior region of the field coil, while maintaining good linearity of the gradient magnetic field (column 14, lines 53-62). This paragraph in the Yui et al reference is immediately followed by the paragraph noted by the Examiner at column 14, lines 63-66, which states that the directions of the currents are opposite in the primary coil and the shield coil, so that the Lorentz forces exerted on the current turns cancel each other, thereby reducing the torque exerted on the gradient coil as a whole. This passage clearly has nothing whatsoever to do with cancelling or suppressing Lorentz forces due to eddy currents, but is instead simply a statement of the general technique that is employed in any apparatus having conductors positioned close to each other that each carry high currents, of making the currents flow in opposite directions so as to cancel the Lorentz forces produced by *those conductors.* The Lorentz forces that are cancelled arise due to the currents flowing in *those conductors,* and therefore this technique has nothing whatsoever to do with suppressing or cancelling Lorentz forces that occur due to eddy currents.

Therefore, the Yui et al reference operates on a completely different underlying concept from that disclosed and claimed in the present application. In the subject matter disclosed and claimed in the present application, no effort is made to prevent the occurrence of eddy currents and the Lorentz forces arising therefrom, but instead a force is applied to an electrically conductive component, separate from the source that generates the eddy currents, so as to preclude movement and deformation of that separate component that would otherwise occur due to the Lorentz forces. By contrast, the Yui et al reference attempts to prevent the

occurrence of Lorentz forces in the first place, by the aforementioned goal of making the "leaking magnetic field" as close to zero as possible. Because of this completely different operating goal, there is no need, and therefore no teaching, in the Yui et al reference to apply a force to any component that would be expected to be moved or deformed by eddy currents. It is assumed in the Yui et al reference that if the apparatus operates as intended so as to make the "leaking magnetic field" as close to zero as possible, virtually no eddy currents, and therefore virtually no Lorentz forces, will occur at all, and therefore there is no need, and thus no teaching, in the Yui et al reference to apply any sort of force to any component for the purpose of counteracting such (non-existent) Lorentz forces.

As to the teachings of the Mansfield et al reference, which the Examiner stated discloses applying mechanical forces to counteract Lorentz forces, Appellant does not agree that the Mansfield et al reference provides such teachings, and moreover the Mansfield reference has no relevance to the subject matter of claim 12, regarding Lorentz forces arising from eddy currents. In the Mansfield et al reference, a coil (presumably a gradient coil) is provided with a shape or design so that the generated Lorentz forces around the closed loop of the coil sum to zero. Additionally, the coil is rigidly potted (held) in casting resin, but this is not to prevent Lorentz forces, but is to prevent the propagation of acoustic waves generated because of any Lorentz forces that might still occur.

Therefore, the Yui et al and the Mansfield et al references operate based on respectively different, and incompatible or competing, premises. The Yui et al reference, as explained above, if operating successfully, *precludes* the generation of Lorentz forces et al. there is thus no reason why a person of ordinary skill in the field

of designing magnetic resonance imaging systems, would seek to modify the Yui et al reference to provide a device of any type that is for the purpose of counteracting Lorentz forces, mechanically or otherwise. Since the Yui et al reference, if its teachings are accepted, achieves an apparatus wherein *no* Lorentz forces are generated at all, there would be no advantage to be gained by modifying that reference with a device to counteract, mechanically or otherwise, such non-existent Lorentz forces.

Moreover, as noted above, the Mansfield et al reference does not even provide a teaching to mechanically generate a force to counteract Lorentz forces, but instead teaches a particular configuration of the component that generates the Lorentz forces, so that the Lorentz forces will sum to zero. The only mechanical aid that is disclosed in the Mansfield et al reference is not for the purpose of counteracting Lorentz forces, but is for the purpose of counteracting the *result* of Lorentz forces, namely the propagation of noise.

Therefore, not only is there no reason for a person of ordinary skill in the field of designing magnetic resonance imaging systems to modify the Yui et al reference in accordance with the teachings of Mansfield et al, but even if such a modification were made (for reasons unknown to the Appellant), the subject matter of claim 12 still would not result.

The Federal Circuit stated in *In re Lee* 227 F.3d 1338, 61 U.S.P.Q. 2d 1430 (Fed. Cir. 2002):

> "The factual inquiry whether to combine references must be thorough and searching. ...It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with."

Similarly, quoting *C.R. Bard, Inc. v. M3 Systems, Inc.*, 157 F.3d 1340, 1352, 48 U.S.P.Q. 2d 1225, 1232 (Fed. Cir. 1998), the Federal Circuit in *Brown & Williamson Tobacco Court v. Philip Morris, Inc.*, 229 F.3d 1120, 1124-1125, 56 U.S.P.Q. 2d 1456, 1459 (Fed. Cir. 2000) stated:

> [A] showing of a suggestion, teaching or motivation to combine the prior art references is an 'essential component of an obviousness holding'.

In *In re Dembiczak*, 175 F.3d 994,999, 50 U.S.P.Q. 2d 1614, 1617 (Fed. Cir. 1999) the Federal Circuit stated:

> Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.

Consistently, in *In re Rouffet*, 149 F.3d 1350, 1359, 47 U.S.P.Q. 2d 1453, 1459 (Fed. Cir. 1998), the Federal Circuit stated:

> [E]ven when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill in the art, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious.

In *Winner International Royalty Corp. v. Wang*, 200 F.3d 1340, 1348-1349, 53 U.S.P.Q. 2d 1580, 1586 (Fed. Cir. 2000), the Federal Circuit stated:

> Although a reference need not expressly teach that the disclosure contained therein should be combined with another, ... the showing of combinability, in whatever form, must nevertheless be clear and particular.

Lastly, in *Crown Operations International, Ltd. v. Solutia, Inc.*, 289 F.3d 1367, 1376, 62 U.S.P.Q. 2d 1917 (Fed. Cir. 2002), the Federal Circuit stated:

> There must be a teaching or suggestion within the prior art, within the nature of the problem to be solved, or within the general knowledge of a person of ordinary skill in the field of the invention, to look to particular sources, to select particular elements, and to combine them as combined by the inventor.

Appellant respectfully submits the Examiner has not satisfied the above-discussed rigorous evidentiary standards for substantiating the rejection of independent claim 12 under 35 U.S.C. §103(a) based on the teachings of Yui et al and Mansfield et al.

Moreover, claims 13-17 add further structure to the non-obvious combination of independent claim 12, and therefore would not have been obvious to a person of ordinary skill in the field of designing magnetic resonance imaging apparatuses under the provisions of 35 U.S.C. §103(a), based on the teachings of Yui et al and Mansfield et al, for the same reasons discussed above in connection with independent claim 12.

Separate Argument in Support of the Patentability of Dependent Claim 13

Claim 13 depends from claim 12, and states that the eddy current generator has a control unit associated therewith, and the force generator has a control unit that operates the force generator dependent on operation of the control unit of the eddy current generator. This claim is intended to cover the embodiment wherein a gradient coil system is the eddy current generator, and the currents that are supplied to the gradient coil system, by its control unit, include a so-called "pre-distortion" of the signal, which is for the purpose of avoiding distortion of the gradient fields, generated by the gradient coil system, caused by eddy current induction and eddy current magnetic fields. Since it is known in advance that the operation of the gradient coil system will unavoidably generate eddy currents, and associated eddy

current fields, and it is also known that these eddy current fields will distort the gradient fields generated by the gradient coil system, the operating currents supplied to the gradient coil system are designed (in a manner previously known in the art to intentionally cause the gradient coils to generate a distorted gradient field so that, when the eddy current field is superimposed thereon, the desired undistorted gradient field will result. Claim 13 claims that the force generator of claim 12 is operated dependent on the operation of this other control unit for the eddy current generator (i.e. the control unit for the gradient coil system).

In the final rejection, the Examiner cited Figure 4, components 107 and 116, of the Yui et al reference as operating in this manner. As noted above, however, the Yui et al reference does not disclose a force generator as set forth in claim 12, and therefore the further details of such an alleged force generator in the Yui et al reference that the Examiner has relied on with regard to claim 13 have no relevance to the force generator of claim 12, and therefore no relevance to the further details thereof set forth in claim 13.

In a telephone interview conducted with the Examiner following the final rejection, the Examiner suggested the Mansfield et al reference provides such a teaching, but did not specifically identify components in the Mansfield et al reference that the Examiner believes provide a teaching with respect to the subject matter of claim 13. As noted above, the Mansfield et al reference discloses a coil with a shape or design so that the generated Lorentz forces around the closed loop of the coil sum to zero. The Mansfield et al reference does not provide any teachings, however, as to how the closed loops are generated. There is no control unit disclosed anywhere in the Mansfield et al reference, and in the few figures in the Mansfield et al

reference that show terminals or leads proceeding from the coil loops, there is nothing that is shown as being connected to those leads.

Therefore, in addition to the aforementioned deficiencies with regard to the teachings of the Yui et al reference, the Mansfield et al reference does not provide any further information that would overcome those deficiencies.

Since claims 14 and 15 depend from claim 13, the above arguments with regard to claim 13 are relevant for those claims as well, but it is not necessary to separately argue the patentability of those claims.

Rejection of Claims 18-22 Under Section 103(a) Based on Yui et al, Mansfield et al and Yoshino et al.

In the final rejection, the Examiner acknowledged that the combination of Yui et al and Mansfield et al does not include a teaching of the force generator being comprised of electrostrictive elements formed by electrostrictive fibers mounted for physical interaction with the electrically conductive structure. The Examiner relied on the Yoshino et al reference as disclosing such a structure.

Appellant acknowledges that the Yoshino et al reference does disclose the use of electrostrictive elements, in the form of piezoelectric elements or devices, to inhibit deformation and vibration of a component of a magnetic resonance imaging apparatus. Similar considerations with regard to the non-obviousness of modifying the Yui et al apparatus in accordance with the teachings of Mansfield et al apply to the Examiner's proposed further modification in view of the teachings of Yoshino et al. The Yoshino et al apparatus operates based on the same presumption as the Mansfield et al reference, namely that Lorentz forces will unavoidably arise in the operation of a magnetic resonance imaging system, and steps must then be taken to

counteract the effect of those Lorentz forces. The piezoelectric elements disclosed in the Yoshino et al reference are for the purpose of preventing propagation of those Lorentz forces and/or acoustic signals generated therefrom, through components of the magnetic resonance imaging apparatus. As noted above, the Yui et al reference operates on a completely different premise, namely to try to preclude the generation of any Lorentz forces at all. Therefore, for the same reasons discussed above in connection with the Mansfield et al reference, if the Yui et al system operates as intended, a person of ordinary skill would assume that no Lorentz forces are being generated in that apparatus, and therefore there would be no reason to modify the Yui et al system in accordance with the teachings of Yoshino et al, since there would (in theory) be no Lorentz forces in the Yui et al reference that would be in need of being damped by the piezoelectric elements disclosed in the Yoshino et al reference.

Therefore, none of claims 18-22 would have been obvious to a person of ordinary skill in the field of designing magnetic resonance imaging systems, under the provisions of 35 U.S.C. §103(a) based on the teachings of Yui et al, Mansfield et al and Yoshino et al.

CONCLUSION:

For the foregoing reasons, Appellant respectfully submits the Examiner is in error in fact and in law in rejecting claims 12-22. Reversal of the those rejections is therefore proper, and the same is respectfully requested.

This Appeal Brief is accompanied by the fee required by 37 C.F.R. §41.20(b)(2) in the amount of $500.00.

Submitted by,

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CERTIFICATE OF MAILING

I hereby certify this correspondence is being deposited with the United States Postal Service as First Class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on September 25, 2006.

Steven H. Noll

STEVEN H. NOLL

APPENDIX "A"

12. A magnetic resonance apparatus comprising:

a basic field magnet for generating a basic magnetic field;

at least one eddy current generator;

at least one electrically conductive structure, other than said eddy current generator, in which eddy currents caused by said eddy current generator can occur, said eddy currents interacting with said basic magnetic field to produce Lorentz forces; and

a force generator attached to said at least one electrically conductive structure, said force generator being designed and controlled for mechanically applying forces to said electrically conductive structure to counteract said Lorentz forces to substantially preclude movement and deformation of said electrically conductive structure due to said Lorentz forces from occurring.

13. A magnetic resonance apparatus as claimed in claim 12 wherein said eddy current generator has a control unit associated therewith, and wherein said force generator comprises a control unit for operating said force generator dependent on operation of said control unit for said eddy current generator.

14. A magnetic resonance apparatus as claimed in claim 13 wherein said eddy current generator comprises at least one coil arrangement for generating a magnetic gradient field.

15. A magnetic resonance apparatus as claimed in claim 14 wherein said control unit of said eddy current generator comprises a predistortion unit for

predistorting a control parameter supplied to said eddy current generator for reducing said eddy currents, and wherein said control unit of said force generator controls said force generator dependent on operation of said predistortion unit.

16. A magnetic resonance apparatus as claimed in claim 12 wherein said electrically conductive structure comprises at least a portion of a magnetic resonance apparatus component selected from the group consisting of a vacuum vessel of said basic field magnet, a cryoshield of said basic field magnet, and a coolant vessel of said basic field magnet.

17. A magnetic resonance apparatus as claimed in claim 12 wherein said electrically conductive structure comprises at least a portion of a magnetic resonance apparatus component selected from the group consisting of a radio-frequency antenna and a radio-frequency shield.

18. A magnetic resonance apparatus as claimed in claim 12 wherein said force generator comprises electrostrictive elements mounted for physical interaction with said at least one electrically conductive structure.

19. A magnetic resonance apparatus as claimed in claim 18 wherein said electrostrictive elements are spatially disposed at said electrically conductive structure with a density corresponding to a relative density of said Lorentz forces.

20. A magnetic resonance apparatus as claimed in claim 18 wherein said electrostrictive elements comprise electrostrictive fibers.

21. A magnetic resonance apparatus as claimed in claim 12 comprising at least one sensor for detecting a magnetic field generated by said eddy currents.

22. A magnetic resonance apparatus as claimed in claim 21 wherein said at least one sensor is connected to said force generator, and wherein said force generator generates said forces for counteracting said Lorentz forces dependent on said magnetic field detected by said at least one sensor.

EVIDENCE APPENDIX

Attachment A - Figs. 1-5 – contained in application as originally filed on July 9, 2004.

Attachment B - United States Patent No. 5,708,360 (Yui et al) cited in final rejection in the May 2, 2006 Office Action.

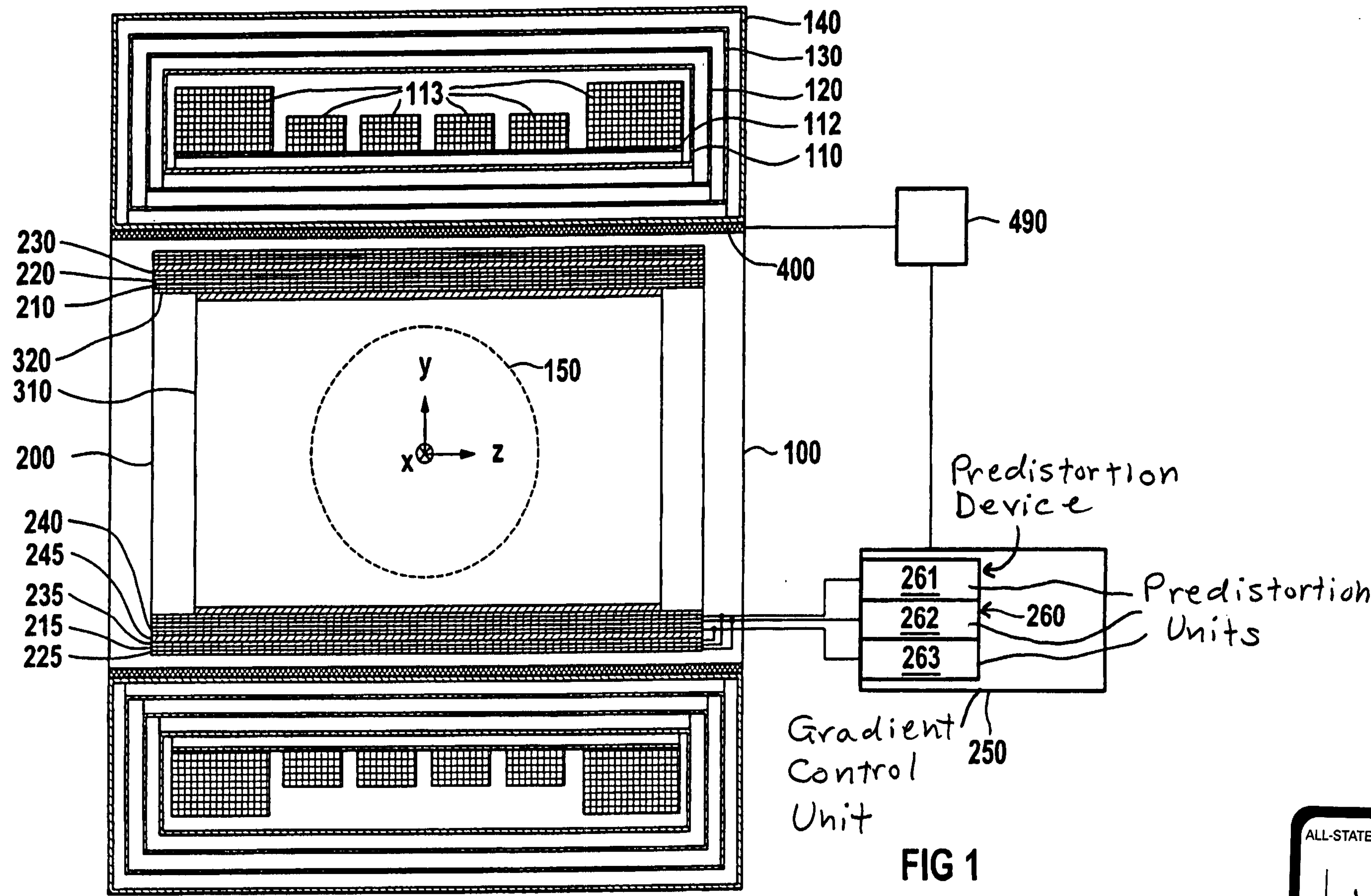
Attachment C – United States Patent No. 5,764,059 (Mansfield et al) – cited in the final rejection in the May 2, 2006 Office Action.

Attachment D – United States Patent No. 5,617,026 (Yoshino et al) – cited in the final rejection in the Office Action dated May 2, 2006.

RELATED PROCEEDINGS APPENDIX

None.

CH1\ 4688877.1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130
120
113
112
110
490
400
230
220
210
320
310
150
y
x
z
200
100
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240
245
235
215
225
261
262
263
260
Predistortion Units
Gradient Control Unit
250

FIG 1

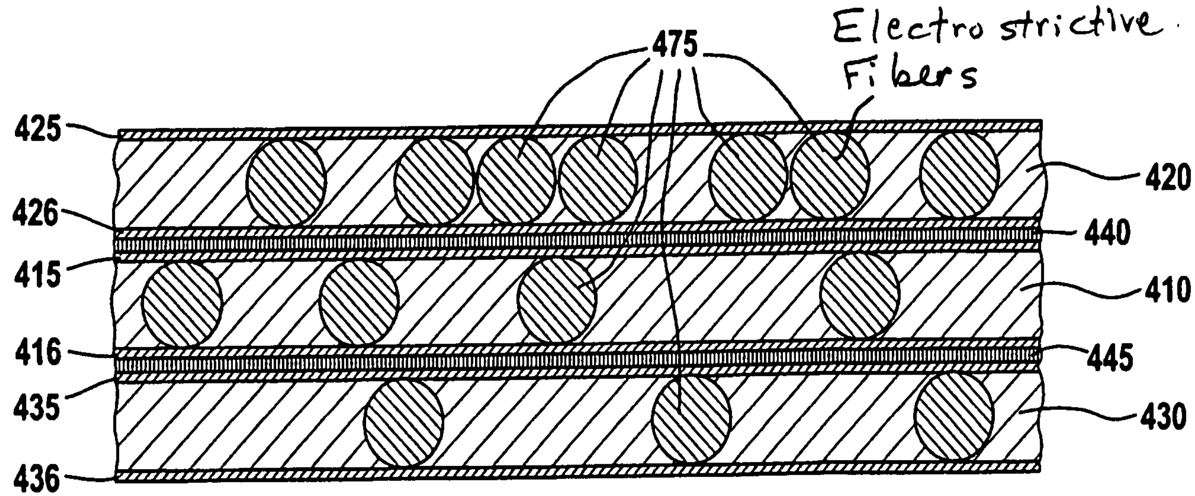
475
Electro strictive
Fibers
425
426
415
416
435
436
420
440
410
445
430

FIG 2

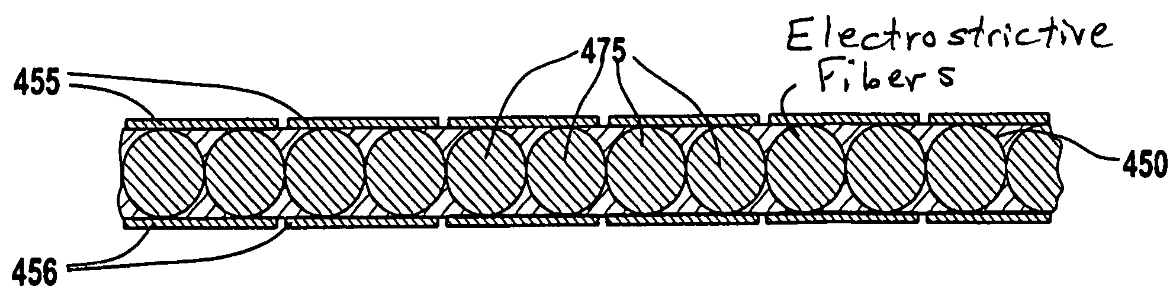
475
Electro strictive
Fibers
455
456
450

FIG 3

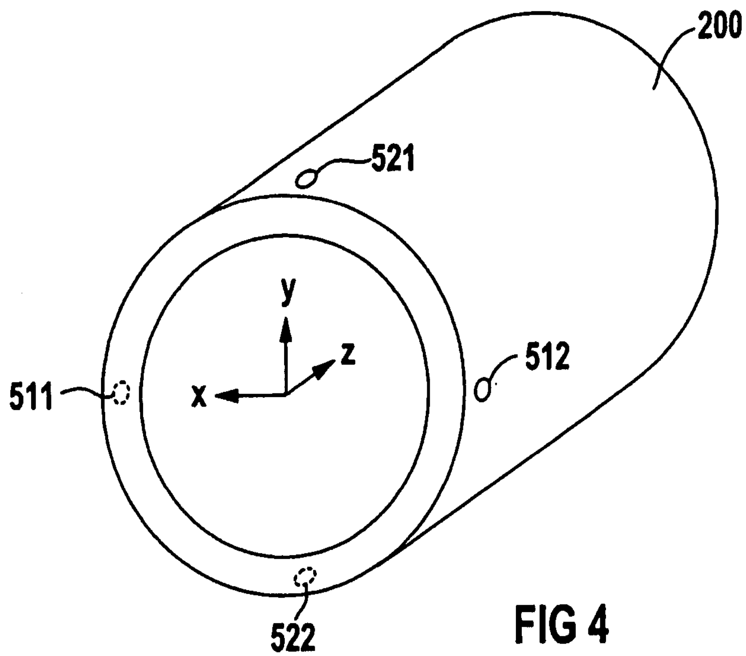

FIG 4

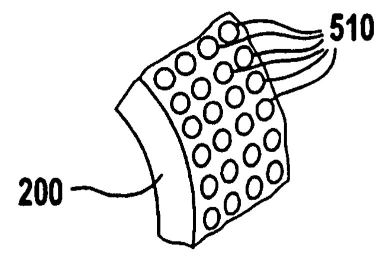

FIG 5